

are usually erect at maturity. The extent of this mutant condition of the heads can be determined satisfactorily only in the field.

Cirsium campylon and *C. fontinale*, as known, are entirely restricted to areas of serpentine rock, and grow only in the boggy soil of springs or along the margins of perennial streams. Geographically, there is the width of the Santa Clara Valley and the eastern slope of the outer South Coast Ranges between the most proximate colonies of *C. campylon* and the typical phase of *C. fontinale*. Thus *C. campylon* is subjected to a more arid, interior climate, with lower average precipitation and less fog, than is typical *C. fontinale*. About two hundred miles south are the two known localities of *C. fontinale* var. *obispoense*, with climatic conditions approximating those of the species proper. Such facts, together with morphological features, suggest that these two highly localized, endemic species arose from a common stock early in the history of the genus in western America, and that climatic and edaphic factors played a considerable part in their segregation and ultimate extreme localization.

State College of Washington, Pullman,
February 10, 1938.

A REALIGNMENT OF THE PANICUM THERMALE GROUP

HAZEL M. SCHMOLL

While attempting to put in order material of the genus *Panicum* in the Herbarium of the Field Museum, considerable morphological variation and distributional discontinuity were noted in specimens referred to *Panicum thermale* Bolander. Reference to the original description of this species and to treatments in various manuals did not clarify the situation. A further study of the group was then suggested by Dr. Julian A. Steyermark of the Field Museum to whom the author is much indebted for criticisms and suggestions. Material was borrowed from the following herbaria: Gray (G), University of California (UC), United States National (US), Field Museum (F) and Rocky Mountain (RM). The writer is grateful to the curators of these herbaria, and especially to Dr. Paul C. Standley of the Field Museum.

As a result of this study it was found that *Panicum thermale* Bolander as currently interpreted is really a complex group consisting of three species and two varieties. Typical *P. thermale* apparently occurs only in the hot springs region of Sonoma and Napa counties, California, while the other species occur near Mount Lassen, California, and in the Rocky Mountains.

The outstanding character which separates the Pacific Coast species of this group from those of the Rocky Mountains is the structure of the panicles. Those of the Pacific Coast species are usually narrower than long, with upright branches, the lower of

which are strongly fasciated, whereas the panicles of the Rocky Mountain species are as broad as or broader than long with lower branches spreading and not strongly fasciated.

Panicum pacificum Hitchcock & Chase is excluded from the *Panicum thermale* aggregate since it lacks the densely velvety pubescent leaves characteristic of that group. It is allied to *P. thermale* and is also especially close to the eastern species, *P. lanuginosum*.

Specimens of *Panicum thermale* from The Geysers, Sonoma County, California, the type locality, differ markedly from other western species of section *Lanuginosa*. They are taller and the densely velvety pubescent leaves are more upright and much longer and narrower. The species is apparently restricted to the vicinity of the type locality and adjacent Napa County. An emended description follows.

PANICUM THERMALE Bolander sp. emend. *P. thermale* Bolander, Proc. Calif. Acad. Sci. 2: 181. 1862.

Plants grayish or light green, densely tufted, 12–42 cm. high; culms erect, slightly geniculate at base, internodes often curved, branches often arising from all but uppermost node along the culm, glabrous or villous, nodes with a dense ring of hairs, glabrous ring usually below node; ligule 3 mm. long; sheaths of main culm rarely overlapping, uppermost sheath elongated, glabrous or villous, densely villous-ciliate on margin, with dense ring of short hairs at collar, papillose; blades of the rosette mostly narrow to linear-lanceolate, 2.1–10 cm. long, 4–6 mm. wide; blades of main culm thick, ascending, and usually almost appressed to the stem, slightly subcordate, taper-pointed, linear-lanceolate, 6–12.5 cm. long, 4–8 mm. wide, uppermost blade reduced, both surfaces densely velvety pubescent, often velvety-villous on the upper surface, especially on the lower half; edge of blade cartilaginous, scabrous; panicles included in sheath or rarely short-exserted, 4–9 cm. long, 1.2–2.7 cm. wide, densely branching, all branches upright, branches on lower part of axis fasciated, densely flowered, lower part of axis and branches pubescent; spikelets obovate-elliptic, obtuse, papillose-pilose, 1.7–2 mm. long, 0.5–1 mm. wide; first glume truncate to acuminate, one-third to one-fourth the length of the spikelet; fruit 1.3–1.6 mm. long, 0.6–0.7 mm. wide.

The autumnal form has reduced leaves occurring in fascicles at the ends of slender branches along the main stem; blades 1–2 cm. long, 1.5–2.5 mm. wide, narrowly lanceolate, acuminate, involute, velvety pubescent on both surfaces, velvety-villous on lower part of upper surface.

CALIFORNIA. Sonoma County: Geysers, 1866, *H. N. Bolander 3941* (type, G); 1860–67, *Bolander 3941* (US, UC); warm loose soil, Geysers, *Bolander 8* (G autumnal form, US); Geysers, 1860–67, *Bolander* (F); Geysers, *Bolander* (F); 1860–67, *Bolander*

(US); ex Herb. Bebb, *Schott* (F); Geysers, June 26, 1877, *Volney Rattan* (UC); Geysers, July 5, 1931, *Marcus E. Jones 29210* (UC). Napa County: near McDonald's, November 10, 1861, *W. H. Brewer 861* (US autumnal form).

Panicum ferventicola sp. nov. Plantae pallide virides atque saepius plus minusve purpurascens, caespitosae, tactu velutinae, in sicco brunnescentes; culmi erecti, pilis adpressis vel patentibus basi saepe bulbosis villosi; vaginae infimae paulo imbricatae, superiores internodiis breviores, pilis adpressis vel patentibus basi interdum bulbosis villosae; laminae culmi lanceolatae e basi cordata versus apicem acutum vel acuminatum angustatae, saepe apice in sicco paulo involutae, 3-5.5 cm. longae 5-9 mm. latae, subtus dense velutinae, supra apice glabrae vel glabratae, infra apicem pilis basin laminae versus sensim longioribus velutino-villosae, margine cartilagineo scabro; paniculae culmorum primariorum longiexsertae, culmorum breviorum subinclusae vel breviter exsertae, 3-6 cm. longae 3-5.5 cm. latae, ca. aequaliter longae et latae, densiflorae, ramis infimis panicularum exsertarum vulgo patentibus dense villosis; spiculae vulgo purpureae piloso-pilosae obtusae obovoideae 1.4-1.7 mm. longae.

Plants light green with varying amounts of purple, tufted, forming dense prostrate mats, velvety to the touch, drying brown; culms stiffly erect, 6.5-31.5 cm. long, lower nodes sometimes geniculate, villous; hairs of ligule 3-3.5 mm. long; sheaths velvety-villous with appressed to spreading hairs sometimes papillose at base; blades of culm lanceolate tapering gradually from a cordate base, acute or acuminate, often becoming slightly involute at tip when dry, 3-5.5 cm. long, 5-9 mm. wide, lower surface densely velvety, upper surface glabrous to glabrate at tip with short hairs to densely velvety with increasingly longer hairs toward base; panicles about as broad as long, 3-6 cm. long, 3-5.5 cm. wide, lower part of axis and branches densely villous; spikelets obtuse, obovate, 1.4-1.7 mm. long, 0.7-1 mm. wide; first glume one-fourth to one-fifth the length of the spikelet; fruit 1.2-1.5 mm. long, 0.6-0.9 mm. wide, elliptic, slightly pointed at tip.

Autumnal forms have numerous shoots arising at the base forming a dense mat; blades not reduced.

WYOMING. Yellowstone National Park: growing in fine gravel in warm soil close to a boiling spring, the plants bathed in hot vapor, forming dense prostrate mats, five miles north of Norris Geyser Basin, August 10, 1908, *Agnes Chase*, American Grasses no. 137, US (type, G; isotypes, UC 184265, F 414079); the Thumb, Yellowstone Lake, September 17, 1902, *E. A. Mearns 4203* (US); prostrate bunches around hot springs, Norris Basin, July 29-30, 1906, *A. S. Hitchcock 1902* (US).

A specimen collected at the borders of hot springs in August 1885, at Yellowstone National Park, (*Tweedy 580*) differs from

the type in the more slender and lax culms, the less stiff leaves and the obovate-elliptic and slightly longer spikelets.

A group of specimens differing from typical *P. ferventicola* could not be separated varietally. Their culms were erect and nine to twenty centimeters long. The loosely clasping, somewhat enlarged sheaths, which were usually overlapping, together with the thicker and usually longer and broader blades (especially those arising from upper nodes of the stem) gave a denser looking mat than is normally found in *P. ferventicola*. The specimens examined are: WYOMING. Yellowstone National Park: altitude 7500 feet, Lower Geyser Basin, August 4, 1897, *Rydberg & Bessey 3546* (G, F, RM); edge of hot pool, July 29, 1926, *H. S. Conrad 1961* (RM); altitude 7400 feet, Upper Basin, July 17, 1906, *W. S. Cooper 102y* (RM). UTAH. Salt Lake City: gardens, 4300 feet, September 4, 1932, *W. D. Stanton 826* (US). Although the blades are not as densely velvety the habit of the following specimens allies them with the group just cited. WYOMING. Yellowstone National Park: on geyser cone slopes, Sylvan Geysers, July 26, 1899, *A. and E. Nelson 6174* (RM) around hot springs on wet bank of Firehole River, Upper Geyser Basin, July 6, 1934, *G. N. Jones 5306* (UC).

Very definite characters separate *Panicum ferventicola* and its varieties from *P. thermale*. The dense, prostrate, light green and purple mat of *P. ferventicola* with its stiff and relatively short ascending or spreading leaves contrast strikingly with the more slender, taller, tufted, light green plant of *P. thermale* with its long, narrow, upright taper-pointed leaves. *Panicum ferventicola*, judging from specimens seen, occurs only about the hot springs throughout Yellowstone National Park.

PANICUM FERVENTICOLA var. **sericeum**, var. nov. Plantae pallide virides caespitosae, culmis gracilibus erectis 7-34 cm. longis saepius e nodis ramosis, villosis, pilis saepe basi papillosis; vaginae in plantis altioribus internodiis breviores, dense papilloso-villosae; laminae lanceolatae e basi cordata sensim angustatae, acutae vel acuminatae, tenues, erectae vel patentes, 4-6.4 cm. longae, 5-11 mm. latae, subtus inter venas breviter dense sericeae, pilis basi papillosis, supra glabrae vel pilosae, margine cartilagineo scabro; paniculae pallide virides vel ad spiculas purpureae, in plantis junioribus longiexsertae, saepius latiores quam longi, 3-5 cm. longae, 3-6.8 cm. latae, ramis patentibus papilloso-villosis; spiculae papilloso-pilosae oblongo-ellipticae usque obovoideo-ellipticae, subacutae, 1.5-2 mm. longae.

Plants light green; culms 7-34 cm. long, usually branching from nodes, villous, base of hairs, especially on lower internodes and upper part of peduncle, often papillose; ligule 3-5 mm. long; sheaths densely covered with papillose-villous hairs; blades thin, lanceolate, gradually tapering from a cordate base, erect to

spreading, 4–6.4 cm. long, 5–11 mm. wide, veins prominent, lower surface satiny, hairs papillose at base, thickly covered with very short silky hairs between the veins, upper surface glabrous or hairy, if glabrous, the surface in some appears corrugated with flattened ridges, in hairy forms the papillae may be separated or united in long lines closely paralleling or covering the veins, all the hairs may be short, or long hairs may be scattered between them and increase in length and density toward the base of the leaf; panicle usually broader than long, 3–5 cm. long, 3–6.8 cm. wide, lower part of axis and branches papillose-villous; spikelets oblong-elliptic to obovate-elliptic, slightly pointed, 1.5–2 mm. long, 0.8–1 mm. wide; first glume truncate to acute, about one-fourth the length of the spikelet; second glume and lemma subequal, shorter than the fruit at maturity; fruit 1.3–1.7 mm. long, 0.8–0.9 mm. wide, slightly pointed.

The autumnal form is shorter than the vernal, more densely tufted at the base, with leaves not reduced, and with panicles included to short exserted.

WYOMING. Yellowstone National Park: in wet ground about hot springs, Mammoth Hot Springs, July 21, 1889, A. & E. Nelson 6037 (RM 20108 type, G); Mammoth Hot Springs, October 15, 1902, E. A. Mearns 4870.

Panicum ferventicola var. *sericeum* may be at once distinguished from *P. ferventicola* by its loose mat of thin, light green leaves with a satiny luster on the lower surface; its panicles, which are broader than long; and its oblong-elliptic to obovate-elliptic spikelets which vary from 1.5 to 2 mm. in length. The absence of purple in the stems and leaves is another peculiarity of this variety.

panicum ferventicola var. papillosum, var. nov. Plantae pallide virides atque plus minusve purpurascens, caespitosae, pilis omnibus basi papillosis, culmis gracilibus erectis 10–25 cm. longis, glabris vel villosis; vaginae adpressae vel patentes, dense velutino-villosae; laminae crassae, adscendentes vel patentes, inferiores ovato-lanceolatae vel late lanceolatae, superiores longiores atque angustiores, 3–5.5 cm. longae, 9–12 mm. latae, utrinque basibus papillosis pilorum asperatae, subtus sparse breviter pilosae, supra apicem versus breviter pilosae, basin versus pilis sensim longioribus pilosae, margine cartilagineo scabro; paniculae vulgo longiexsertae atque latiores quam longae, 2.2–4.3 cm. longae, 2.2–4.9 cm. latae, ramis infimis patentibus densifloris villosis; spiculae purpureae papilloso-pilosae, ellipticae vel obovoideo-ellipticae, 1.7–2 mm. longae.

Plants light green with varying amounts of purple, all hairs papillose at base; culms 10–25 cm. long, branches arising from nodes along the culm, glabrous to villous; ligule 3–4 mm. long; sheaths densely velvety-villous; blades of culm thick, stiffly ascending or spreading, ovate or broadly lanceolate at base of

stem, uppermost and those on branches longer and narrower, 3–5.5 cm. long, 9–12 mm. wide, both surfaces roughened by large papillae at base of hairs, lower surface with scattered hairs about 1 mm. long, upper surface usually with short, scattered hairs near tip and increasingly longer hairs near base; panicle broader than long, 2.2–4.3 cm. long, 2.2–4.9 cm. wide, sparsely villous below panicle, base of axis branches villous; spikelets purple, elliptic to obovate-elliptic, 1.7–2 mm. long, 0.8–1 mm. wide; first glume about one-third the length of the spikelet; fruit 1.5–1.7 mm. long, 0.7–0.9 mm. wide.

ALBERTA. Banff, on a declivity wet with water from hot spring, July 21, 1914, *A. S. Hitchcock*, American Grasses no. 220, US (G, type; F 427157 isotype); Banff, vicinity of basin, altitude 4600 feet, June 8, 1906, *Stewardson Brown 17* (G).

Panicum ferventicola var. *papillosum* is most readily distinguished from *P. ferventicola* by its papillose-roughened, broader leaves, its panicles which are broader than long, and its elliptic to obovate-elliptic spikelets 1.7 to 2 mm. long. Specimens of this variety are recorded only from the vicinity of Banff, Alberta.

Panicum lassenianum, sp. nov. Plantae pallide virides atque ubique purpurascens, caespitosae; culmi adpressi vel patentes villosi 13–35.5 cm. longi; ligula 3 mm. longa; vaginae dense papilloso-villosae, pilis adpressis vel saepius patentibus; laminae crassae, erectae vel patentes, lanceolatae ad lineari-lanceolatae, supra basin angustatae, pungentes, in sicco superne involutae, subtus longe vel breviter velutino-pilosae, pilis brevibus atque longis saepe intermixtis, supra pilis longis et brevibus intermixtis vulgo sparse pilosae; paniculae inclusae usque longiexsertae, 5.5–6.5 cm. longae, 2.5–3.3 cm. latae, vulgo ca. duplo longiores quam latae, densiflorae, ramis erectis, infimis fasciculatis; spiculae purpureae obovoideo-ellipsoideae papilloso-pilosae 1.8–2 mm. longae, 0.8–1 mm. latae.

Plants light green and purple throughout, tufted, forming dense mats; lower nodes of longest culms geniculate and branching, nodes with dense ring of hairs and glabrous band below node; culms appressed to spreading, villous, 13–35.5 cm. long, internodes of culms often curved; ligule 3 mm. long; sheaths densely papillose-villous with appressed or usually spreading hairs; blades thick, stiffly upright to spreading, lanceolate to linear-lanceolate, narrowed above the base, pungent, becoming involute on upper part when dry, lower surface with short or long hair or both, velvety pubescent with hairs rather sparse to dense, upper surface with short hair and long hair intermixed both usually sparsely scattered, the long hair occurring on the lower half of the leaf, the tip of the leaf often glabrous, blades of main culm 4.5–7.5 cm. long, 6–9 mm. wide; panicles included to long-exserted, 5.5–6.5 cm. long, 2.5–3.3 cm. wide, usually about twice

as long as wide, branches upright, lower branches of axis fasciated, densely flowered; spikelets purple, obovate-elliptic, papillose-pilose, 1.8–2 mm. long, 0.8–1 mm. wide, first glume truncate to acute tipped, about one-fourth to one-half the length of the spikelet, 0.3–0.6 mm. long; fruit 1.5 mm. long, 0.8 mm. wide.

CALIFORNIA. Plumas County: Devil's Kitchen, Hot Spring Valley, 6200 feet, June 6, 1910, *W. L. Jepson 4082* (type, US 725572). *Panicum lassenianum* resembles *P. ferventicola* in its light green and purple densely prostrate mat and its ascending or slightly spreading, stiff, velvety leaves. As first noted by Dr. Steyermark, however, the pubescence of the lower leaf surface is often not as dense as in *P. ferventicola*; furthermore the two species are widely separated geographically. The panicle, narrower than long and with ascending, rather densely fasciated branches, places *P. lassenianum* with *P. thermale* and *P. pacificum* of the Pacific states. The predominance of densely velvety leaves, however, indicates that it has a closer relationship to *P. thermale* than to *P. pacificum*.

In the following key *P. lanuginosum* Ell., although an eastern species, has been included because, in common with the new entities, it resembles closely the Pacific states group.

Lower surface of leaves densely velvety-pubescent.

Plants tufted, tall, always some shade of green, never purplish; autumnal leaves reduced.

Culms 1.2–4.2 dm. long; panicles included; spikelets 1.7–2 mm. long, 0.5–1 mm. wide; autumnal blades not ciliate

P. thermale

Culms 4–7 dm. long; panicles exserted; spikelets 1.8–1.9 mm. long, 1 mm. wide; autumnal blades ciliate

P. lanuginosum

Plants forming dense prostrate mats with varying amounts of purple; autumnal leaves not reduced.

Panicles included to exserted, not as broad as long, densely branched, the branches ascending, the lower branches usually fasciated; spikelets 1.8–2 mm. long

P. lassenianum

Panicles long-exserted, as broad as long, branches spreading; spikelets 1.4–1.8 mm. long

P. ferventicola

Lower surface of leaves not densely velvety-pubescent.

Leaves thin, lanceolate, satiny on lower surface, short silky hairs papillose at base and occurring in rows parallel with the veins; veins conspicuous; panicles 3–6.8 cm. wide

P. ferventicola
var. *sericeum*

Leaves thick, stiff, ovate to broadly lanceolate, papillose-roughened on both surfaces, hairs scattered; panicles 2.2–4.9 cm. wide

P. ferventicola
var. *papillosum*

Field Museum of Natural History,
Chicago, Illinois, April 17, 1938.